unbundled elements; or (c) because such switch equipment can be easily collocated in standard collocation cages or integrated into other equipment that consumes no more space than other equipment without such functions, prohibiting collocation would be discriminatory. In sum, our testimony demonstrates that, if CLECs are not able to collocate switching functionality, CLECs' incentives to invest and innovate will be reduced, CLECs' ability to serve many customers will be limited, and even those customers that CLECs do serve will have fewer competitive alternatives for both voice and advanced services.

II. BACKGROUND: SWITCHING FUNCTIONALITY

A. The Switching and Transmission Trade-Off

4. This declaration focuses upon the functions and the equipment associated with such functions within the broad category of switching.[1] Switching functionality is necessary because it is impossible to interconnect directly every telephony subscriber with every other telephony subscriber. Early on in the deployment of the telephony network, it was clear that it would not be practical to establish – nor would customers be willing to pay for – dedicated transmission facilities to every other location on the network. Human cord board operators provided the earliest form of switching functionality and, upon request by a customer, would manually establish a connection between the calling and the called party. Mechanized switches were subsequently developed to replace human operators in order to reduce cost, speed connections, and utilize transmission facilities more efficiently.

[1] Transmission and surveillance functionality is discussed within the Declaration of Robert Frontera and Thomas W. Hill, Jr., which is also attached to AT&T's Comments in this proceeding.

5. In the intervening years, the technology used to implement switching functionality evolved from electro-mechanic to stored program control technology (both of which were based upon analog transmission technology), to circuit switches that employ digital transmission, and to packet switching technology. These evolutions were driven by a desire to reduce costs and to improve service quality, including performance and additional service capabilities. The choices that are made regarding deployment of switch functionality continue to be an economic trade-off between the cost of full-time dedicated connections between specific destinations and the cost of deploying the infrastructure that serves the same destinations using existing facilities on a shared basis.

6. The trade-off analysis is generally straightforward in concept, but its application requires detailed, location-specific information. Essentially, a network engineer will choose to incur the costs to deploy additional switching functionality if it will reduce, by a greater extent, the total cost of transport facilities and equipment. In practice, the analysis is very complex. Local switches are deployed to minimize the cost of serving customers (i.e., interconnecting loops) in a specific geographic area. Tandem switches are deployed to minimize the total cost of interconnecting local switches and connecting the local switches to the long distance network.

7. Of particular interest for this proceeding is the cost of serving a local geographic area where the CLEC has relatively few variables to control. For a CLEC that chooses to pursue facilities-based entry, it has two options: First, the CLEC can "backhaul" all loops it seeks to serve from the ILEC switch (where all loops currently terminate) to a remote location for switching. Second, the CLEC can deploy some form of switching

functionality in the ILEC office and avoid the costs of backhauling all of its customers' loops or a subset of those loops. Use of switching functionality can reduce transport costs either by (i) increasing the efficiency of the CLEC's transport facilities or (ii) eliminating some of the CLEC's need to backhaul traffic to and from loops that terminate within the same collocation. The economies resulting from reducing the need for transport of voice traffic may occur when there is a relatively small community of interest for the customers in an office, as occurs in more rural areas, or a relatively large corporate location that is located close to a central office. In those instances, use of switching functionality in collocated space allows the direct connection of the end users' loops without the need for any backhaul to a remote location. For data traffic, economies associated with increased transport efficiency may result when customers have "bursty" communications of relatively high band width, or when a customer location generates a mix of voice and data traffic that can be combined onto a single loop. In these instances, deploying packet switch functionality may reduce the need for loops to the customer premises and/or facilities to the CLEC's data network.

B. The Functions Of A Switch

8. In general terms, switching is the functionality that selects, integrates and manages the temporary use of transmission functionality for a user. As such, switching is analogous to cross-connection. In the case of switching functionality, the cross-connection is executed dynamically (in near real time), rather than being relatively static, as occurs with dedicated transmission facilities between two points.

9. - Switching functionality includes four supporting sub-functions, although the implementation of the functionality may differ based upon the technology employed.

> a. *Facility termination* functionality provides the physical interface between the transmission functionality (whether loop or trunk) and the other switching functionality.
>
> b. *Scanning/polling* functionality monitors the facility termination for a change in state and determines whether the change in state (e.g., off-hook or trunk seizure) indicates a fault (i.e., facility failure) or a request for switching functionality.
>
> c. *Request processing* functionality includes conveying readiness to process a request (e.g., dial tone), decoding the request (e.g., MF tones for dialed digits or analyzing the cell header of a packet), and communicating the status of the request (e.g., ringing/busy/fast busy). Much of the request processing functionality involves temporary interconnection (through the equivalent of an intra-equipment telecommunication network) to shared service circuits and other peripheral equipment necessary to establish a continuous communication link.
>
> d. *Link integration* functionality delivers the transmission functionality between two points for the temporary use of the requesting party.

10. Two sub-functions exist within the link integration function. First, *facility selection* identifies and reserves the transmission functionality needed to transfer information between points. Two different networking strategies may be implemented through the facility selection functionality. The first is connection-oriented networking. In this case, a limited number of end-to-end physical paths are defined for use by the switch. The switch selects the path based upon information directly or indirectly supplied by the end user. Once the switch selects a path, the path is used for the duration of the communications transfer. The second strategy is connectionless networking. With this approach, the switch selects a path to the next network resource (which may be another

switch or the desired customer line). The path selected need only have the potential to advance the communications to its ultimate destination. In connectionless networking (of which the Internet is the best example), all packets comprising an individual communication do not necessarily follow the same physical path to the desired end point.[2] Circuit switches are employed within connection-oriented networks, while packet switches may be employed in either connection-oriented or connectionless networks.

11. In the case of circuit switching, the customer-dialed digits are translated (via a table) into one or a group of useable transmission facility terminations (which may involve intermediate switching functionality as well) necessary to physically interconnect the originator and the end-point of the communications. Similarly, for connection-oriented packet networks (e.g., ATM networks), information contained in the header of the packet or data cell is translated (via a table) into one or a group of facilities that are, or can be, physically linked to connect with the desired destination for the information. For connectionless packet networks, on the other hand, the communications path is selected on a packet-by-packet basis using information in the cell header. The cell header information is used in conjunction with pre-defined tables to identify the cells' "next hop" through the network. Based upon facility terminations available at each instant of time, the switch determines the path to the next network resource that has the best potential for ultimately

[2] The packets traversing a connectionless network do not necessarily arrive in the same sequence that they are transmitted, nor do they necessarily arrive at predictable intervals because they may take different paths to the final destination. As a result, either network or CPE functionality, based on information within the packet header, must perform appropriate re-sequencing of the packets when they arrive. Such activities (and uncertainties) interject delay and are typically more problematic for voice communication than for data communications.

providing connectivity to the desired end-point. In all cases the switch, whether packet or circuit switched, scans the identified facility terminations to find an idle and useable facility. When such a facility is identified, appropriate signaling is sent to the far end (another switch or a loop termination) to reserve the facility and permit the initiation of information transfer. A table look-up, based upon the termination selected, tells the switch how signaling and supervision should be handled.

12. The second sub-function of link integration is *path management.* This functionality monitors the facility to assure that transmission can begin and to determine that transmission has ceased so that the reserved facility can be released. For circuit switched technology, path management functionality is largely limited to these two areas of basic support.[3] In contrast, path management functionality for packet switching is somewhat more complex. For packet switching, the path management functionality provides two services. First, just as for circuit switching, it monitors the path and releases it when no other end-to-end communications between the same locations are required. Second, it monitors the switch buffers to assure that the buffers are emptied and appropriate priority is given to each buffer for transfer of its contents (cells) to the transmission facilities.[4]

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[3] If the established transmission path is interrupted for any reason, the path management functionality of the circuit switch will perceive that the communication is completed and "tear down" the entire communications link. If the transmission was not in fact complete, the communication must be re-initiated by the end user, because information necessary to create the link exists only at call initiation (by review of the dialed digits).

[4] For example, ATM switches permit creation of various classes of priority such as Constant Bit Rate ("CBR"), Variable Bit Rate ("VBR") and Available Bit Rate ("ABR"). CBR guarantees a specific maximum amount of bandwidth that is not over-subscribed. Variable Bit Rate guarantees the user a minimum amount of bandwidth but, if additional capacity is temporarily available, the capacity also may be utilized. ABR makes capacity available with

13. Given the preceding, it is clear that the primary purpose served by switching is to allow carriers to use transport facilities efficiently. The first and foremost economic savings achieved by switching functionality is the elimination of physical facilities. Second, switching functionality, and particularly packet switching technology, allows more efficient use of channels within a physical facility.

14. When circuit switching technology was initially developed, the existing capabilities (mostly processing speed) did not permit switches to make case-by-case, real-time decisions regarding how a particular facility's bandwidth might be flexibly sub-divided and efficiently used. As a result, the physical paths on a circuit switched network have defined bandwidth and that capacity is made available to users in fixed increments, regardless of whether the full capacity is actually required for a particular communication. Subsequent improvement in computer technology, however, has allowed extremely fast decision making regarding how much capacity exists between end-points (e.g., the virtual circuit), how much

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no assurances as to how much capacity will be made available at a particular time. The physical path may be subdivided into subunits of capacity through the use of software in the switch (e.g., Permanent Virtual Circuits or PVCs) into which the various service classes are mapped to buffers, which are in turn mapped to virtual circuits. The provisioned capacity of the virtual circuits may exceed the transmission capacity of the facility, called overbooking, by a factor of 2:1 to 20:1, depending on the traffic types and its delay sensitivity. This is possible due to the bursty nature of packet data traffic. By using the buffers to temporarily store the packets, the switch can "smooth" or "shape" a short burst of traffic that exceeds the transmission capacity, into a longer burst that will fit. In addition, since many customers share the same transmission facility, the chance that they all will send a burst at the same time is very small. Thus the combination of packet buffers together with the "law of large numbers" allows overbooking to very effectively lead to much higher utilization than through TDM technology. The combined total of the buffer capacity may exceed the capacity of the virtual circuits but the combined capacity of the virtual circuits may not exceed the transmission capacity of the facility.

information needs to be transferred at a particular instant of time (e.g., how full a buffer may be), and what relative priority each communication possesses (e.g., the buffer class of service). As a result, packet switches have the ability to use the available transmission capacity more flexibly, thereby providing CLECs with the ability to more fully utilize the capacity in their transmission facilities.

15. In fact, packet switching blurs the distinction between switching functionality and transmission functionality. The packet switch selects a transmission path and thereby perform a switching function. However, to the extent it also manages the delivery of communication to a facility in order to maximize the use of the facility – commonly referred to as statistical multiplexing – a packet switch also performs a transmission function.

16. Finally, as with transmission functionality, it is critical that the overall operation of equipment elements be monitored. This functionality is called surveillance. As applied to switching, surveillance monitors the entire platform of switches and transmission facilities for faults and error conditions, audits the equipment configurations to check database consistency, controls the allocation and switchover of redundant equipment, and manages the installation of new hardware and software. For the same reasons discussed in the transmission declaration, CLECs will be substantially impaired if they are practically denied the ability to collocate surveillance functionality with collocated switching functionality.[5]

[5] The surveillance functionality is discussed in detail in the declaration of Robert Frontera and Thomas W. Hill, Jr.

III. THE COMMISSION SHOULD FIND THAT CLECs MAY COLLOCATE SWITCHING FUNCTIONALITY IN ILEC OFFICES.

17. CLECs need to deploy at least two types of equipment with switching functionality in collocated space: packet switches and remote switch modules.

A. Remote Switch Modules

18. A remote switch module, or RSM, performs a number of interrelated functions, although an RSM must always be used in conjunction with a full function switch, which is called the "host" switch. Primarily, an RSM provides a way for carriers to obtain access to local loops, and to connect them with full function host circuit switch, so that traffic may be switched and carried over other network facilities. Thus, an RSM can provide a way of terminating loops, and also a concentration and multiplexing function when it connects the loops to a host office.

19. An RSM also has limited – but critically important – switching capabilities.[6] Where one customer served by loops connected to the RSM calls another customer connected to the same RSM, the RSM can itself complete the call, eliminating the use of interoffice facilities connected to the host switch. In this manner, the RSM makes those facilities available for other uses and thereby reduces a CLEC's costs. An RSM, however, cannot operate as an independent, stand-alone switch, and does not provide all of the switching functionalities described above in Part II. Rather, the host switch to which it must be connected provides additional functionality. An RSM can perform basic routing to

[6] As the Commission recognized in the Local Competition Order, (¶ 581) "modern technology has tended to blur the line between switching equipment and multiplexing equipment."

other loops to which it is connected, but the host switch performs, inter alia, recording functions, such as the call detail information that is needed to perform billing,[7] out-of-band signaling functions that is required for calls that must be routed to other switches, and electronic maintenance functions, including monitoring and testing the quality of the telecommunications equipment connected to the switch.

20. The RSM therefore performs multiple functions, see First Collocation Order ¶ 29 ("remote switching modules, which terminate circuits and perform multiplexing and switching functions, do not function as stand-alone switches, but rather provide integrated functionalities in a single piece of equipment"), and it is necessary to collocate RSMs in an incumbent LEC's central office in order for those functions to be performed and for the CLEC to use an RSM to provide competitive service.

21. Just as with other equipment that performs concentration and multiplexing functions, an RSM can be deployed to terminate loops, and then to transport efficiently the traffic on such loops to and from the full function host switch. For the same reasons that other concentration and multiplexing equipment must be deployed in the incumbent LEC central office, it is necessary to deploy RSMs in collocation to take advantage of these aspects of its functionality. It simply is not possible or cost-effective to extend loops to be terminated to an RSM that is deployed at a location distant from the central office. See Frontera/Hill Declaration.

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[7] If the connectivity to the host switch is lost for more than a limited amount of time (typically 24 hours), locally stored billing information in the RSM will be lost because its data storage buffers will be over-written regardless of any inability to transfer such billing data to the host switch.

22. Likewise, to take advantage of an RSM's limited switching functionality, it is also necessary for the RSM to be placed in the ILEC central office. For calls between loops terminating on the same collocation space, the cost savings that can result from collocating an RSM can be substantial. A carrier deploying an RSM to handle such calls does not incur the facility costs of carrying such calls all the way to the host switch, and then back again to the RSM for termination to complete the customer-to-customer connection. These "backhaul" transmission costs can be quite high and, for that reason, ILECs today routinely deploy RSMs in their networks to reduce costs and increase operating efficiency.

23. A simple example illustrates these costs. An RSM deployed by a CLEC and collocated at an ILEC central office (which also houses an ILEC switch) would allow calls to be completed directly between two of the CLEC's customers that are served by local loops connected to that RSM. Such a call would travel from the originating customer's telephone, over the unbundled loop the CLEC leases from the ILEC to serve the originating customer, to the CLEC RSM collocated in the ILEC office where the loop terminates. Then, because the call is to another of the CLEC's customers served from the same office, the RSM would switch the call to the unbundled loop serving the called customer. The call would be routed in the same central office where both customers' loops are terminated.[8] By contrast, if a CLEC cannot collocate RSMs, then in the same call scenario, it would incur

[8] This is the most, efficient, least cost manner in which a call could be completed between two CLEC customers served over an ILEC's unbundled loops. Because ILECs use RSMs in their networks to achieve precisely the same types of cost efficiency and savings, in order to compete effectively with these ILECs, CLECs must have the same opportunities to deploy RSMs and to route traffic efficiently.

additional and substantial costs: once the originating call reached the ILEC central office, the CLEC would have to pass the call through multiple layers of multiplexing and electrical-to-optical signal conversion and proceed to route the call out of the ILEC's central office on a interoffice transport facility to the CLEC's own stand alone switch. The CLEC switch would connect the call to a facility returning to the very same central office, which means the call would used the capability of the switch to connect to what would likely be a different time division slot in the same transport facility used to reach the switch, which would likely be demultiplexed by the same equipment used to connect the originating party to the switch so that the call could be completed to a customer's loop in the same collocation.

24. The inefficiency of this approach is plain. The CLEC's expenses for completing these calls would be markedly higher if collocation were not permitted (and higher than those of the ILEC) because the CLEC would incur substantially more transport costs, and would require a distant stand-alone switch to handle the call, even though an RSM could effectively perform this task more efficiently. Thus, any restriction on collocation of RSMs will only increase CLEC costs, degrade service to CLEC customers, and ultimately impede competition on the merits.

25. The increased costs that CLECs would incur if they were not permitted to collocate RSM in an ILEC's central office would occur in all areas. But for areas where transport costs are particularly high – like sparsely populated and rural areas – the increased costs could often be so substantial that CLECs simply could not afford to enter the market at all.

26. Moreover, some large and sophisticated customers themselves have recognized the efficiencies to be gained through the use of RSMs, and have required that carriers deploy them to meet the customer's telecommunications demands. For example, in Oregon, AT&T is serving a customer that solicited bids from carriers and expressly required that the bidders use RSMs to serve the customer's locations. AT&T, having been awarded the contract, has now deployed RSMs in its collocation space in Oregon.[9] Given that customers may demand that carriers use RSMs to provide services, any limitation on a CLEC's right to collocate RSMs may entirely preclude the CLEC from serving these types of customers.

27. A practical consideration that must be kept in mind is that the investment per subscriber line for RSMs is typically substantially greater than for a fully functional local circuit switch. In round figures, the average investment per RSM line is about 40 percent higher than the investment per line for a typical stand alone circuit switch. Given this economic fact, a CLEC will deploy a RSM only when other compelling considerations exist, such as (1) the prospect of obtaining the conditioned and secure real estate along with obtaining necessary facility rights of way and facility access and egress is so protracted that market entry will be unacceptably delayed, (2) the needs of a specific customer dictate the deployment of a small RSM, or (3) the potential market size is insufficient to justify the fixed costs of a full local switch (i.e., backhaul is too costly), but too large to justify reliance upon backhaul solely with a DLC. No CLEC will deploy a RSM

[9] Collocation of RSMs, as permitted under FCC rules, had been authorized by the Oregon Commission.

simply to consume scarce collocation space and thereby deny itself access to such space for other purposes. Therefore, provided that space is available in a central office (and particularly if space is available within the confines of already procured space), the collocation of a RSM should be permitted without limitation. What is unique with respect to RSMs is that, if the Commission were to determine that RSMs cannot be deployed within collocated space, then CLECs would be highly unlikely to deploy RSMs at all. In order to deploy a RSM anywhere other than in collocation, the CLEC would need to incur much of the backhaul infrastructure costs to take a customer's loop from the collocation to another intermediate site where the RSM functionality could permissibly be located. Therefore, the ability to minimize the backhaul costs that were the very basis on which the economics of the RSM would be justified is largely eliminated by prohibiting deployment of RSMs in collocated space.

28. Finally, any decision to forbid collocation of RSMs because they offer limited switching functionality would be patently discriminatory. An RSM performs multiplexing, concentration and other transmission functions. Furthermore, RSMs fits within a standard collocation cage, and does not require any additional space in the central office by virtue of its switching function.[10] Therefore, any ILEC's refusal would be patently discriminatory and anticompetitive: it would not be based on any concern to conserve space

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[10] When a CLEC terminates about 4000 lines in collocation, the DLC equipment will consume about the same amount of floor space as the RSM cabinets required to terminate the same number of lines. Above this number of lines, an RSM will generally consume less space.

in its central office, but only upon a desire to handicap its competitors from using the RSM's efficient and cost-saving switch functionality.

B. Packet Switching

29. In at least three respects, packet switching is far more efficient than traditional circuit switching technology. First, packet switches have a smaller footprint. For example, a packet switch that requires a single equipment rack (a footprint of about 9 square feet) can easily terminate and switch the transmission capacity equivalent to 100,000 DS0s.[11] A circuit switch that terminates 100,000 voice grade lines would occupy about 500 square feet.[12] Furthermore, packet switching technology is modular in design and easily grown in small increments of capacity. Circuit switching technology, on the other hand, was initially developed with an emphasis on high reliability, limited bandwidth and long asset life, rather than an ability to adapt to rapidly changing network configurations.[13]

30. Second, packet switches can move data more efficiently than circuit switched networks. Packet networks can achieve rates of about 621 Mbps (i.e., OC-12) for

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[11] A DS0 is 64 kbps of bandwidth. It is generally equivalent to the bandwidth of one voice circuit. A typical packet switching product used by carriers (e.g., the Cisco MGX-8850, which measures about 18 inches wide by 30 inches tall by 21 inches wide) consumes about 9 square feet of floor space, including an allowance for isle space.

[12] This figure assumes that about 45 cabinets would be required and that each cabinet would consume about 11 square feet (i.e., 2 feet wide, 2.5 feet deep, plus isle allowance)

[13] Circuit switching is extremely well adapted to voice communications, which remains a substantial portion of communications carried today. In fact, carrying voice on packet networks is still somewhat inefficient. This is because TDM formats must be carried in the packet structure, thereby inefficiently using bandwidth. Further, issues of delay voice traffic handled on packet networks, particularly in a connectionless network such as the Internet, must still be resolved. Thus, for the foreseeable future, circuit switching will remain a viable technology.

individual customer connections. Furthermore, only packet switches can implement a connectionless network architecture, and such networks are less impacted by failure of transmission facilities or intervening switches. In connectionless oriented networks, packet switches are continually determining – millions of times per second – the appropriate route to employ for individual packets. Thus, should an element fail, there is a low probability that any individual packet would be impacted. This, in fact, was a central design principle of the first packet network, the ARPANET. Circuit switching, in contrast, is limited to a maximum data rate of 56 kbps on the line side and, under certain conditions, 1.5 Mbps on the trunk side. Additionally, circuit switches tear down all connections when a facility fails and requires the users to re-establish the connection.

31. Third, packet switches utilize transmission facilities extremely efficiently. Because such transmission facilities are costly, this is the primary economic advantage of packet switching. As discussed above, a circuit switch reserves a dedicated path for each active call even when no information is actually being transmitted – i.e., when there is silence on a voice call. In packet switching, by contrast, transmission capacity is used only when actual information is being sent. By turning customers' data or voice signals into structured packets with headers containing destination and priority information, the packet switch can share the available transmission bandwidth among many customers on a dynamic, packet-by-packet basis. This technique is called statistical multiplexing, and depending on the nature of the traffic patterns and the acceptability of delay, the economic gains can be anywhere from 2:1 to 20:1 or more.

32. In order to enable CLECs to take advantage of the benefits of packet switching, they must be able to collocate packet switch functionalities in an ILEC central office, for several reasons, the most important of which are to enable them to achieve the efficient use of transmission facilities and to ensure greater reliability for customers.

33. In order to maximize the efficiency of packet switching and attain the economic advantages of statistical multiplexing that packet switching offers, the equipment must be placed in the network as close to the customer as possible to minimize expensive transmission costs. Typically, the first place that large numbers of facilities (loops) come together in a place suitable for electronic equipment is in the ILEC central office. If the packet switch functionality is not located there, then the customer communications must be transported using time division multiplexed (TDM) facilities. As discussed above and in the transmission declaration, TDM facilities, while more efficient than non-multiplexed facilities, reserve transmission capacity for one end user that may not require it at a particular instant, but deny capacity to another end user that may need it at the same time. Given the recognized high cost to CLECs to deploy such interoffice facilities and the inability of CLECs in most instances to deploy their own cost-competitive loop facilities, CLECs must be afforded all reasonable means to optimize the use of interoffice transport facilities, and collocation of packet switches is essential to achieve that goal.

34. AT&T today currently uses packet switches in its network to provide a combination of voice and data services, and to share dynamically the voice and data traffic on a single facility connecting to AT&T's network, thereby reducing significantly the necessary transmission costs. For example, a customer, such as a large retail store, might

have large amounts of both voice traffic (served with a PBX) and data traffic (i.e., from its cash registers). AT&T can deploy a packet switch, in conjunction with specialized equipment at the customer's premises, that takes both the voice and data traffic, converts them into cells or packets, and sends both types of traffic over a single facility to the AT&T packet switch. The packet switch then directs packets containing the voice communications to facilities connecting to AT&T's traditional circuit switched network and directs the packets containing the data traffic to facilities connecting to a separate ATM data network. By performing both a packetizing and a multiplexing function, the packet switch allows data and voice to be sent over the same lines connecting to the customer's premises, saving the carrier (and the customer) from incurring additional transmission costs associated with inefficiently and under utilized loops.

35. Furthermore, collocation of packet switches can also improve network reliability. For example, a CLEC that deploys multiple DSLAMs in collocated space to offer access to advanced services might ordinarily dedicate a transport "uplink" facility to each DSLAM in order to terminate the DSLAM's output on a packet switch capable of routing the data packets received. If an outage or other problem develops in the uplink facility used for a DSLAM, then all the customers served by that DSLAM would be affected. By contrast, if a carrier can deploy packet switch functionality in the collocated space along with the DSLAMs, it can rely on the packet switch's ability to select (and efficiently use) an alternative facility providing connectivity into and out of the collocation. This type of protection switching at Layer 2, the link layer, is much more efficient than simply providing double the bandwidth needed at the physical layer as might be done, for example, if a

SONET ring to be used. Therefore, because packet switching can better assure quality of service, CLECs should be permitted to place such functionality in collocated space to allow them to be more competitive with the ILEC network, to have robust alternate routing capabilities, and generally to have more abundant transmission capacity available.

36. Finally, and as with remote switch modules discussed above, it would be entirely discriminatory and anticompetitive to allow ILECs to preclude collocation of packet switches. As noted, packet switches have a smaller footprint than circuit switches; the packet switches that AT&T has deployed can fit in a standard-sized equipment rack and take up less space than multiplexing equipment typically found in collocation cages. Accordingly, packet switches should be permitted in collocated space for the practical reason that space is no less efficiently utilized – and may actually make more space available – than the technological alternative (DLC) that is much less flexible and efficient.

I declare under penalty of perjury that the foregoing is true and correct. Executed on October 11, 2000.

Anthony L. Culmone
Oct. 11, 2000

I declare under penalty of perjury that the foregoing is true and correct. Executed on October 11, 2000.

Stephen L. Holmgren

Stephen L. Holmgren

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Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matters of	)	
	)	
Deployment of Wireline Services Offering Advanced Telecommunications Capability	)	CC-Docket No. 98-147
	)	
and	)	
	)	
Implementation of the Local Competition Provisions of the Telecommunications Act of 1996	)	CC Docket No. 96-98

DECLARATION OF JOSEPH P. RIOLO

IV. QUALIFICATIONS ON BEHALF OF AT&T CORPORATION

1. My name is Joseph Riolo. I am an independent telecommunications consultant. My business address is 102 Roosevelt Drive, East Norwich, New York 11732. I submit this declaration in support of AT&T in the above-captioned proceeding.

2. My practice currently focuses on infrastructure design and deployment, and construction and costing with regard to the local loop.

3. I have submitted expert testimony on matters related to telephone plant engineering in California, Delaware, Florida, Hawaii, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, New Jersey, New York, Ohio, Pennsylvania, Virginia, West Virginia, Wisconsin, the District of Columbia, and before the FCC. I have personally engineered all manner of outside plant including underground, aerial and buried plant in urban, suburban and rural environments. I have engineered copper and fiber plant as well as provisioned analog and

digital services. I have participated in the design, development and implementation of methods and procedures relative to engineering planning, maintenance and construction.

4. During the course of my career, I have had opportunities to place cable (both copper and fiber), splice cable (both copper and fiber), install DLC, test outside plant, and perform various installation and maintenance functions. I have prepared and awarded contracts for the procurement of materials. I have audited and performed operational reviews relative to matters of engineering, construction, assignment, and repair strategy in each company throughout the original 22 operating companies of the Bell System. I have directed operations responsible for an annual construction budget of $100 million at New York Telephone Company. My responsibilities included, but were not limited to, engineering, construction, maintenance, assignment and customer services. This experience was obtained while holding the following positions related to the provision of local telephone outside plant facilities:

5. Between 1987 and 1992, I was the NYNEX Engineering Director-Long Island. In that position, I was responsible for budgeting, planning, engineering, provisioning, assignment and maintenance of telecommunications services for all customers on Long Island, N.Y.

6. Between 1985 and 1987, I was NYNEX District Manager-Midtown Manhattan. I was responsible for budgeting, planning, engineering, provisioning, assignment and maintenance of telecommunications services for all customers in Midtown Manhattan.

7. Between 1980 and 1985, I was NYNEX District Manager-Engineering Methods. In that capacity, I was responsible for the design, development, implementation and review of all outside plant methods and procedures for New York Telephone Company. Additionally, I was

responsible for the procurement of all outside plant cable and apparatus for the New York Telephone Company.

8. Between 1978 and 1980, I was an AT&T District Manager, responsible for the design, development and documentation of various Bell System plans, and for audits and operational reviews of selected operating companies in matters of Outside Plant engineering, construction, assignment and repair strategy. I also served as the Project Team Leader at Bell Telephone Laboratories for the design and development of functional specifications for mechanized repair strategy systems.

9. Between 1976 and 1978, I was District Manager-Outside Plant Analysis Center for New York Telephone Company. I was responsible for the analysis of all outside plant maintenance reports and the design, development and implementation of related mechanized reporting, analytical and dispatching systems. I was also responsible for the procurement of all outside plant cable and apparatus for the New York Telephone Company.

10. Between 1962 and 1978, I held a variety of technical and engineering positions of increasing responsibility at New York Telephone and Bell Telephone Laboratories. During 1967 and 1969, I was on military leave of absence from New York Telephone while serving in the U.S. Navy. I hold a B.S. in Electrical Engineering from City College of New York, and have taken a variety of specialized courses in telecommunications since college.

II. PURPOSE AND SUMMARY OF THE DECLARATION

11. In my declaration, I explain how the traditional ILEC loop architecture was initially designed to accommodate analog voice service. In particular, I detail how the ILECs